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jv809 U.S. PTO

UTILITY PATENT APPLICATION TRANSMITTAL
(Large Entity)

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.
699866/034

Total Pages in this Submission

TO THE ASSISTANT COMMISSIONER FOR PATENTS

Box Patent Application

Washington, D.C. 20231

Transmitted herewith for filing under 35 U.S.C. 111(a) and 37 C.F.R. 1.53(b) is a new utility patent application for an invention entitled:

SOLID-STATE LASER APPARATUS EXCITED BY LASER LIGHT FROM SEMICONDUCTOR LASER UNIT HAVING INCREASED RESONATOR LENGTH

jc625 U.S. PTO 09/552540 04/19/00

and invented by:

Hisashi Ohtsuka
Yoji Okazaki

If a CONTINUATION APPLICATION, *check appropriate box and supply the requisite information:*

☐ **Continuation** ☐ **Divisional** ☐ **Continuation-in-part (CIP)** of prior application No.: ______

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Which is a:

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Enclosed are:

Application Elements

1. ☒ Filing fee as calculated and transmitted as described below

2. ☒ Specification having 18 pages and including the following:

   a. ☒ Descriptive Title of the Invention

   b. ☐ Cross References to Related Applications *(if applicable)*

   c. ☐ Statement Regarding Federally-sponsored Research/Development *(if applicable)*

   d. ☐ Reference to Microfiche Appendix *(if applicable)*

   e. ☒ Background of the Invention

   f. ☒ Brief Summary of the Invention

   g. ☒ Brief Description of the Drawings *(if drawings filed)*

   h. ☒ Detailed Description

   i. ☒ Claim(s) as Classified Below

   j. ☒ Abstract of the Disclosure

P01ULRG/REV04

UTILITY PATENT APPLICATION TRANSMITTAL (Large Entity) *(Only for new nonprovisional applications under 37 CFR 1.53(b))*	Docket No. 699866/034
	Total Pages in this Submission

Application Elements (Continued)

3. ☒ Drawing(s) *(when necessary as prescribed by 35 USC 113)*
   - a. ☒ Formal Number of Sheets 3
   - b. ☐ Informal Number of Sheets ______
4. ☒ Oath or Declaration
   - a. ☐ Newly executed *(original or copy)* ☒ Unexecuted
   - b. ☐ Copy from a prior application (37 CFR 1.63(d)) *(for continuation/divisional application only)*
   - c. ☒ With Power of Attorney ☐ Without Power of Attorney
   - d. ☐ <u>*DELETION OF INVENTOR(S)*</u>
Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. 1.63(d)(2) and 1.33(b).
5. ☐ Incorporation By Reference *(usable if Box 4b is checked)*
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.
6. ☐ Computer Program in Microfiche *(Appendix)*
7. ☐ Nucleotide and/or Amino Acid Sequence Submission *(if applicable, all must be included)*
   - a. ☐ Paper Copy
   - b. ☐ Computer Readable Copy *(identical to computer copy)*
   - c. ☐ Statement Verifying Identical Paper and Computer Readable Copy

Accompanying Application Parts

8. ☐ Assignment Papers *(cover sheet & document(s))*
9. ☐ 37 CFR 3.73(B) Statement *(when there is an assignee)*
10. ☐ English Translation Document *(if applicable)*
11. ☒ Information Disclosure Statement/PTO-1449 ☒ Copies of IDS Citations
12. ☐ Preliminary Amendment
13. ☒ Acknowledgment postcard
14. ☒ Certificate of Mailing
    - ☐ First Class ☒ Express Mail *(Specify Label No.)*: EL 486 775 125 US

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UTILITY PATENT APPLICATION TRANSMITTAL
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Docket No.
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Accompanying Application Parts (Continued)

15. ☒ Certified Copy of Priority Document(s) *(if foreign priority is claimed)*

16. ☐ Additional Enclosures *(please identify below)*:

Fee Calculation and Transmittal

CLAIMS AS FILED

For	#Filed	#Allowed	#Extra		Rate	Fee
Total Claims	6	- 20 =	0	x	$18.00	$0.00
Indep. Claims	1	- 3 =	0	x	$78.00	$0.00
Multiple Dependent Claims (check if applicable) ☐						$0.00
					BASIC FEE	$760.00
OTHER FEE *(specify purpose)*						$0.00
					TOTAL FILING FEE	$760.00

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Dated: april 19, 2000

Signature

Lawrence Rosenthal
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New York, New York 10038

cc:

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Applicant(s): **Hisashi Ohtsuka et al.**			**699866/034**
Serial No.	Filing Date	Examiner	Group Art Unit
New Application	**Herewith**		

Invention: **SOLID-STATE LASER APPARATUS EXCITED BY LASER LIGHT FROM SEMICONDUCTOR**

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SOLID-STATE LASER APPARATUS EXCITED BY LASER LIGHT FROM SEMICONDUCTOR LASER UNIT HAVING INCREASED RESONATOR LENGTH

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a semiconductor-laser-excited solid-state laser apparatus in which a solid-state laser crystal is excited by excitation laser light emitted from a semiconductor laser unit as an excitation light source, and emits laser light.

Description of the Related Art

Currently, there are demands for increase in output power and improvement in quality of solid-state laser apparatuses. In response to these demands, a solid-state laser apparatus achieving high output power is proposed. In the proposed solid-state laser apparatus, a solid-state laser crystal of Nd:YAG, Nd:YVO_4, Nd:YLF or the like is excited by excitation laser light emitted from a broad-guide semiconductor laser unit having a high power output. In addition, as a widespread technique, the laser light generated by the solid-state laser crystal may be converted into a second harmonic wave by providing a wavelength conversion element made of, for example, a nonlinear crystal or a domain-inverted $LiNbO_3$, in an external

resonator arranged outside of the solid-state laser crystal.

On the other hand, in the current semiconductor-laser-excited solid-state laser apparatuses, the excitation light source is driven under a so-called automatic power control (APC) so as to stabilize the laser oscillation. That is, a portion of output laser light is monitored and fed back to the excitation light source so as to reduce variation in the output laser light. In order to stabilize the output laser light by the automatic power control, it is desirable that the ratio of an increase in the output of the semiconductor laser unit to an increase in the output of the solid-state laser apparatus is constant, i.e., the output of the solid-state laser apparatus monotonously increases with the increase in the output of the semiconductor laser unit.

Nevertheless, in practice, the output of the solid-state laser apparatus does not monotonously increase even when the output of the semiconductor laser unit is increased by 10% or 20%. In a typical example of the solid-state laser apparatus, the output of the solid-state laser apparatus reaches a level of saturation when the output of the semiconductor laser unit is increased by 8% over an initial driving state.

The above problem is caused by deviation of the

oscillation wavelength of the semiconductor laser unit from a desired absorption peak of the solid-state laser crystal. Since a great amount of heat is generated by the semiconductor laser unit, the oscillation wavelength of the semiconductor laser unit is highly dependent on the driving current. That is, the oscillation wavelength of the semiconductor laser unit shifts toward the longer wavelength side with increase in the driving current. Consequently, the deviation of the oscillation wavelength of the semiconductor laser unit from the desired absorption peak of the solid-state laser crystal becomes great.

For example, in a known semiconductor-laser-excited solid-state laser apparatus, a solid-state laser crystal of Nd:YAG is excited by excitation laser light having a wavelength of 809 nm emitted from a semiconductor laser unit, and emits laser light having a wavelength of 946 nm. The full width at half maximum of the peak of the oscillation wavelength at which the solid-state laser crystal of Nd:YAG best absorbs light is very small, i.e., at most 10 nm. Therefore, even when the shift of the wavelength of the excitation laser light is only a few nanometers, the wavelength of the excitation laser light deviates from the desired absorption peak of the solid-state laser crystal of Nd:YAG, and therefore the excitation laser light cannot

be efficiently absorbed by the solid-state laser crystal of Nd:YAG. Thus, even when the driving current (driving power) is greatly increased, the increase in the output power of the solid-state laser apparatus is often small.

In order to solve the above problem, an attempt has been made to suppress the dependence of the oscillation wavelength of the semiconductor laser unit on the driving current by enhancing radiation effect of the semiconductor laser unit during emission of high power laser light. As disclosed in Japanese Unexamined Patent Publication No. 10(1998)-190131, which is assigned to the present assignee, an attempt has been made to optimize a mechanical member which fixes a semiconductor laser unit so as to enhance radiation efficiency and reduce the dependence of the oscillation wavelength of the semiconductor laser unit on the driving current.

However, when the output power of the semiconductor laser unit is further increased, the above optimization of the mechanical member is insufficient to sufficiently reduce the dependence of the oscillation wavelength of the semiconductor laser unit on the driving current.

Japanese Patent Application No. 11(1999)-82723, which is also assigned to the present assignee,

proposes a method for solving the above problems. In the proposed method, provision is made in driving of the semiconductor laser unit so that the deviation of the oscillation wavelength of the semiconductor laser unit is prevented. Nevertheless, the characteristic of the semiconductor laser unit per se has not been fundamentally improved by the method. Therefore, output loss occurs in the solid-state laser apparatus. Thus, it is not possible to further increase the output power by the method.

SUMMARY OF THE INVENTION

The object of the present invention is to provide a semiconductor-laser-excited solid-state laser apparatus in which stable automatic power control is performed, and from which high power laser light is output.

According to the present invention, there is provided a semiconductor-laser-excited solid-state laser apparatus includes a solid-state laser element and a semiconductor laser unit including a resonator. The solid-state laser element is excited by light emitted from the semiconductor laser unit, and emits laser light. The resonator length in the semiconductor laser unit is arranged to be at least 0.8 mm.

According to the present invention, the resonator length in the semiconductor laser unit is arranged to

be at least 0.8 mm, which is longer than the lengths of the resonators in the semiconductor laser units in the conventional semiconductor-laser-excited solid-state laser apparatuses. Since heat is mainly generated in the resonator of the semiconductor laser unit, the area of the semiconductor laser unit which is in contact with a radiation member such as a heatsink is increased with the increase in the resonator length, and therefore ability to dissipate the heat generated in the semiconductor laser unit is enhanced. Accordingly, the dependence of the oscillation wavelength of the semiconductor laser unit on the driving current can be remarkably reduced. Thus, the wavelength of the excitation laser light does not substantially deviate from an absorption band of the solid-state laser crystal, in which the solid-state laser crystal best absorbs the excitation laser light. Thus, the solid-state laser crystal can be efficiently excited, and a stable laser output can be obtained from the semiconductor-laser-excited solid-state laser apparatus.

In addition, the substantial area of the light emitting portion of the semiconductor laser unit is increased due to the above increase in the length of the resonator. Therefore, the operating current density can be reduced. Accordingly, it is possible to prevent deterioration of the semiconductor laser unit due to

damage of the light emitting portion caused by the high current density. Thus, reliability of the semiconductor-laser-excited solid-state laser apparatus can be increased.

Preferably, the resonator length in the semiconductor laser unit is at least 1 mm. It is further preferable that the length of the resonator is at least 1.5 mm.

Further, the semiconductor-laser-excited solid-state laser apparatus according to the present invention may further comprise a second resonator which is formed by the solid-state laser element and a mirror arranged outside of the solid-state laser element, and a wavelength conversion element which is arranged in the second resonator, and generates a second harmonic wave.

DESCRIPTION OF THE DRAWINGS

Fig. 1 is a diagram illustrating the construction of the semiconductor-laser-excited solid-state laser apparatus in an embodiment of the present invention.

Fig. 2 shows graphs of the second harmonic wave output versus the output power of the semiconductor laser unit in semiconductor-laser-excited solid-state laser apparatuses in which lengths of resonators in the semiconductor laser units are respectively 0.5 mm, 0.75 mm, 1 mm, 1.5 mm, 2 mm, and 3 mm.

Fig. 3 is a graph illustrating the relationship between the wavelength shift in the semiconductor laser output and the resonator length in the semiconductor laser unit.

DESCRIPTION OF PREFERRED EMBODIMENTS

Embodiments of the present invention are explained in detail below with reference to drawings.

Fig. 1 is a diagram illustrating the construction of the semiconductor-laser-excited solid-state laser apparatus in an embodiment of the present invention. The semiconductor-laser-excited solid-state laser apparatus of Fig. 1 comprises a semiconductor laser unit 11, condenser lenses 12a and 12b, a solid-state laser medium 13, a resonator mirror 14, quarter-wave plates 15 and 16, an optical wavelength conversion element 17, a polarization control element 18, a wavelength selection element 19, a beam splitter 22, an optical detector 23, and an automatic power control (APC) circuit 24.

The semiconductor laser unit 11 emits a laser beam 10 as excitation light. The condenser lenses 12a and 12b condense the laser beam 10, which is originally divergent light. The solid-state laser medium 13 is, for example, a neodymium-doped YLF crystal (Nd:YLF crystal). The resonator mirror 14 is arranged at the forward end of a solid-state laser resonator 31. The

quarter-wave plates 15 and 16 are provided on the forward and back sides of the Nd:YLF crystal 13 for realizing the so-called twist mode oscillation in the solid-state laser resonator. The optical wavelength conversion element 17, the polarization control element 18, and the wavelength selection element 19 are arranged on the forward side of the quarter-wave plate 16 in this order.

In addition, the semiconductor laser unit 11 and the condenser lenses 12a and 12b are fixed on a mount 30 to form an excitation unit. The mount 30 is made of, for example, copper, and the excitation unit is maintained at a predetermined temperature by a temperature control element and a temperature control circuit, which are not shown.

The optical wavelength conversion element 17 is made of an MgO-doped $LiNbO_3$ crystal, and periodic domain-inverted structure is formed in the MgO-doped $LiNbO_3$ crystal. For example, the polarization control element 18 is realized by a Brewster plate, and the wavelength selection element 19 is realized by an etalon.

The semiconductor laser unit 11 emits the laser beam 10 having a wavelength of 797 nm. When neodymium ions in the Nd:YLF crystal 13 are excited by the laser beam 10, the Nd:YLF crystal 13 emits light having a

wavelength of 1,313 nm.

The outer end surface 15a of the quarter-wave plate 15 is coated so that the outer end surface 15a allows passage of the excitation laser light 10 having the wavelength of 797 nm, and efficiently reflects light having the wavelength of 1,313 nm or 657 nm, where the outer end surface 15a of the quarter-wave plate 15 has a form of a concave mirror. The light having the wavelength of 657 nm will be explained later. The mirror surface 14a of the resonator mirror 14 is coated so that the mirror surface 14a efficiently reflects light having the wavelength of 1,313 nm and the excitation laser light 10, and allows passage of a portion of the light having the wavelength of 657 nm. Therefore, the light having the wavelength of 1,313 nm resonates between the outer end surface 15a of the quarter-wave plate 15 and the mirror surface 14a of the resonator mirror 14 to generate laser oscillation. The optical wavelength conversion element 17 converts the light having the wavelength of 1,313 nm into a second harmonic wave, which is the above light having the wavelength of 657 nm. Thus, a Fabry-Perot solid-state laser resonator 31 is formed between the outer end surface 15a of the quarter-wave plate 15 and the mirror surface 14a of the resonator mirror 14, and almost only the second harmonic wave 21 is output through the

resonator mirror 14. In the Fabry-Perot solid-state laser resonator 31, the direction of the linear polarization is controlled by the polarization control element 18, and single-wavelength oscillation is realized by the wavelength selection element 19.

The beam splitter 22 is provided on the forward side of the resonator mirror 14 so that a first portion of the laser light emitted through the resonator mirror 14 is received by the optical detector 23, and the second portion 21 of the laser light passes through the beam splitter 22 and is output from the semiconductor-laser-excited solid-state laser apparatus of Fig. 1. The optical detector 23 is realized, for example, by a photodiode, and detects the intensity of the first portion of the laser light emitted through the resonator mirror 14. The detected result (the output of the optical detector 23) is supplied to the automatic power control (APC) circuit 24, and the automatic power control (APC) circuit 24 controls the driving current of the semiconductor laser unit 11 based on the output of the optical detector 23 so that the intensity of the second harmonic wave 21 output from the semiconductor-laser-excited solid-state laser apparatus of Fig. 1 is maintained constant.

Fig. 2 shows graphs illustrating relationships between the second harmonic wave output and the output

power of the semiconductor laser unit, in semiconductor-laser-excited solid-state laser apparatuses in which the resonator lengths in the semiconductor laser units are respectively 0.5 mm, 0.75 mm, 1 mm, 1.5 mm, 2 mm, and 3 mm. As illustrated by the curve b in Fig. 2, when the output power of the semiconductor laser unit is increased by 10% from 2.0 W to 2.2 W in the conventional semiconductor-laser-excited solid-state laser apparatus in which the resonator length in the semiconductor laser unit is 0.75 mm, the increase in the second harmonic wave output is only 4%. That is, the solid-state laser is not efficiently excited by the semiconductor laser unit having the 0.75 mm long resonator.

On the other hand, the second harmonic wave output is increased by 8% with 10% increase in the output power of the semiconductor laser unit having a 1.5 mm long resonator, as illustrated by the curve d in Fig. 2. That is, the increase in the second harmonic wave output is doubled when the resonator length in the semiconductor laser unit is increased from 0.75 mm to 1.5 mm. When the resonator length in the semiconductor laser unit is further increased, the second harmonic wave output can be increased accordingly, as illustrated in Fig. 2. For example, in the semiconductor-laser-excited solid-state laser apparatus

in which the resonator length in the semiconductor laser unit is 3.0 mm, the second harmonic wave output increases linearly with the increase in the output power of the semiconductor laser unit, as illustrated by the curve f in Fig. 2. That is, an ideal output characteristic is obtained when the semiconductor laser unit includes the 3.0 mm long resonator.

Fig. 3 is a graph illustrating the relationship between the wavelength shift and the resonator length in the semiconductor laser unit. In Fig. 3, the blank circles indicate the wavelength shift values in the output of the semiconductor laser unit when the semiconductor laser unit including a 1.0 mm long resonator is simply fixed to a block stem as a fixture; the blank squares indicate the wavelength shift values when the semiconductor laser unit having a 1.5 mm long resonator is simply fixed to a block stem as a fixture; the filled circle indicates the wavelength shift value when the semiconductor laser unit having a 1.0 mm long resonator is mounted in a laser diode (LD) package; and the filled squares indicate the wavelength shift values when the semiconductor laser unit having a 1.5 mm long resonator is mounted in a laser diode (LD) package. In the laser diode (LD) package, the semiconductor laser unit is in contact with a heatsink or the like, and is provided with a cooling apparatus.

As illustrated in Fig. 3, although the wavelength shift value is about 1.4 nm/A when the semiconductor laser unit is mounted in the laser diode (LD) package having a 1.0 mm long resonator, the wavelength shift values are reduced to about 1.1 to 1.3 nm/A when the resonator length in the semiconductor laser unit mounted in the laser diode (LD) package is increased to 1.5 mm. That is, when the resonator length in the semiconductor laser unit is arranged to be at least 1.0 mm, it is possible to maintain the wavelength shift values within the width of the absorption band of the solid-state laser crystal, and obtain a stable laser output. In addition, it is preferable that the resonator length in the semiconductor laser unit is arranged to be at least 1.5 mm. Although not shown in Fig. 3, when the resonator length in the semiconductor laser unit is further increased, the wavelength shift values can be reduced to at most 1 nm/A, and a further stable optical output can be obtained.

The present invention can be applied to all types of semiconductor-laser-excited solid-state laser apparatuses. For example, the scope of the present invention is not limited to the semiconductor-laser-excited solid-state laser apparatuses in which wavelength conversion is performed by an optical wavelength conversion element. The advantages of the

present invention can be obtained in other semiconductor-laser-excited solid-state laser apparatuses in which the wavelength conversion of the solid-state laser light is not performed.

In addition, all of the contents of the Japanese patent application No. 11(1999)-113482 are incorporated into this specification by reference.

What is claimed is:

1. A semiconductor-laser-excited solid-state laser apparatus comprising:

a semiconductor laser unit including a first resonator; and

a solid-state laser element which is excited by light emitted from the semiconductor laser unit, and emits laser light;

wherein said first resonator has a length of at least 0.8 mm.

2. A semiconductor-laser-excited solid-state laser apparatus according to claim 1, wherein said first resonator has a length of at least 1 mm.

3. A semiconductor-laser-excited solid-state laser apparatus according to claim 1, wherein said first resonator has a length of at least 1.5 mm.

4. A semiconductor-laser-excited solid-state laser apparatus according to claim 1, further comprising,

a second resonator which is formed by said solid-state laser element and a mirror arranged outside of said solid-state laser element, and

a wavelength conversion element which is arranged in said second resonator, and generates a second harmonic wave.

5. A semiconductor-laser-excited solid-state

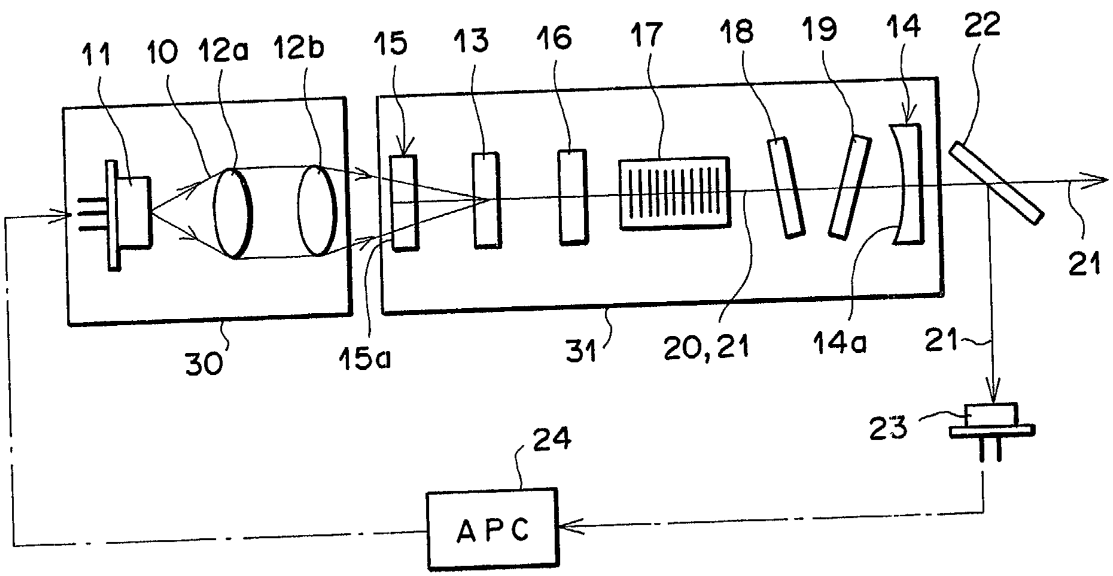
laser apparatus according to claim 4, wherein said first resonator has a length of at least 1 mm.

6. A semiconductor-laser-excited solid-state laser apparatus according to claim 4, wherein said first resonator has a length of at least 1.5 mm.

ABSTRACT OF THE DISCLOSURE

A semiconductor-laser-excited solid-state laser apparatus includes a solid-state laser element and a semiconductor laser unit including a resonator. The solid-state laser element is excited by light emitted from the semiconductor laser unit, and emits laser light. The resonator length in the semiconductor laser unit is arranged to be at least 0.8 mm, so as to reduce an amount of wavelength shift in light emitted from the semiconductor laser unit, and achieve a stable, high-power laser output from the semiconductor-laser-excited solid-state laser apparatus.

FIG. 1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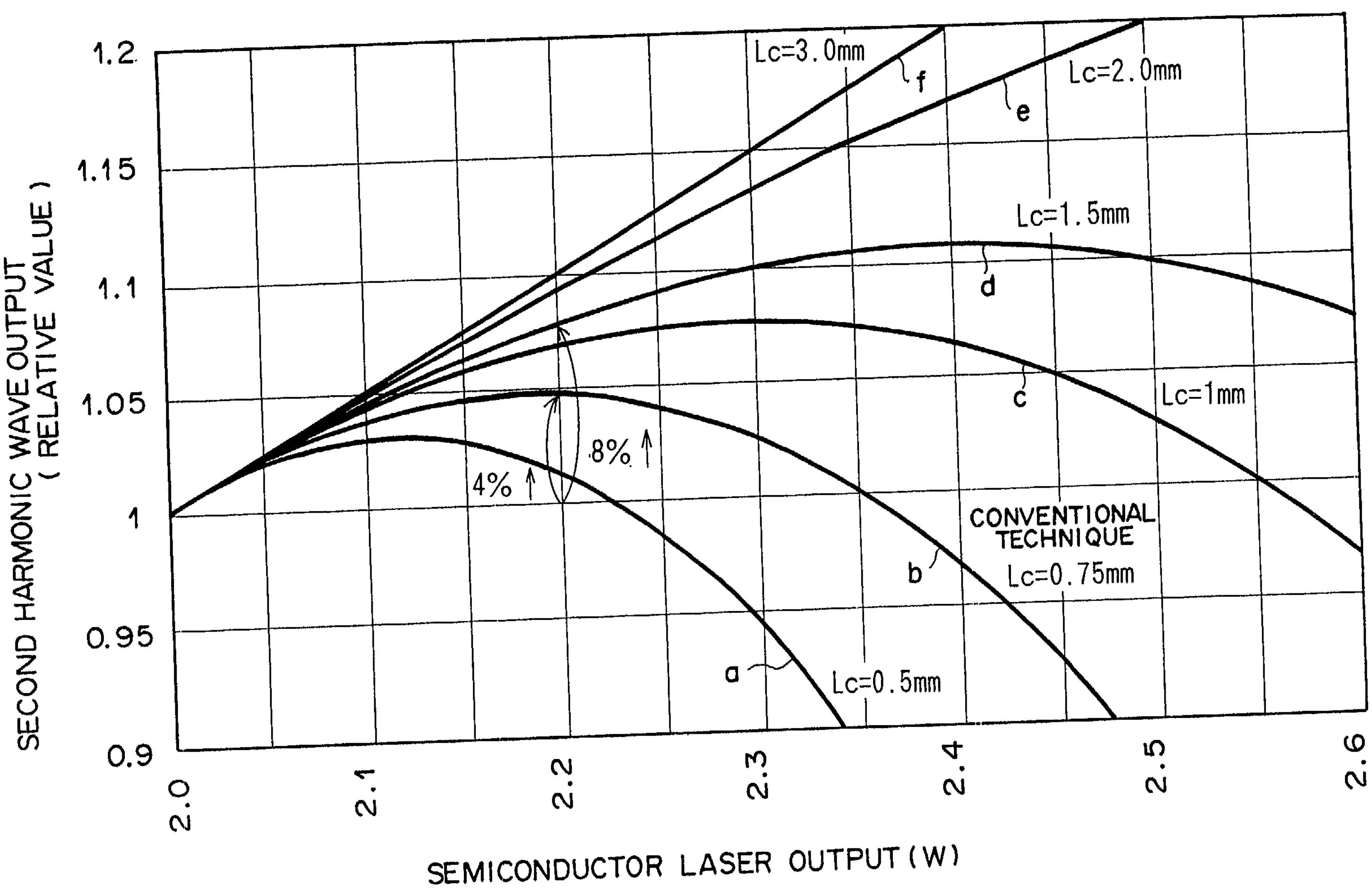
APC

F I G . 2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1.1
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0.9
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2.1
2.2
2.3
2.4
2.5
2.6
SEMICONDUCTOR LASER OUTPUT (W)
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f
Lc=2.0mm
e
Lc=1.5mm
d
c
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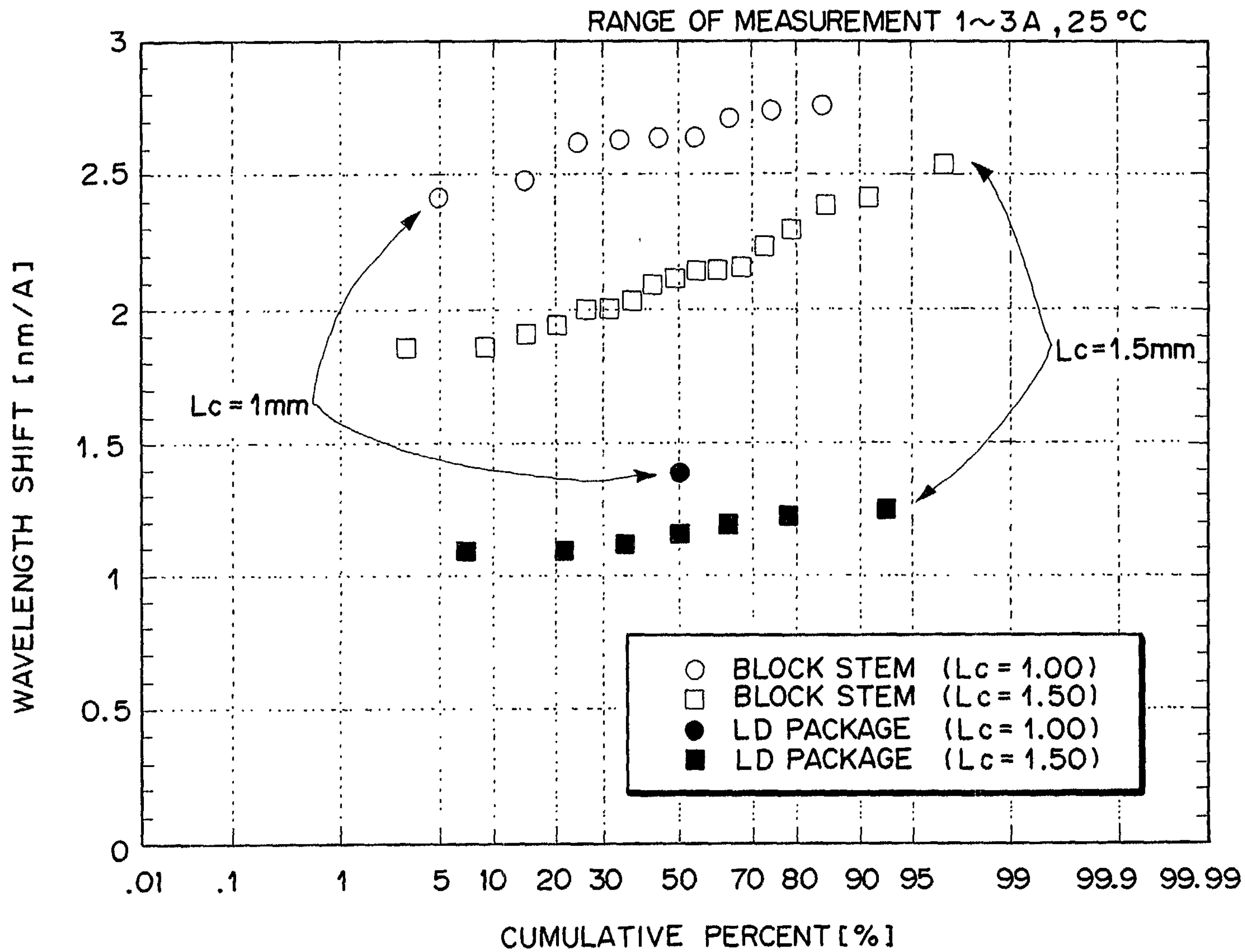
4%
CONVENTIONAL TECHNIQUE
b
Lc=0.75mm
a
Lc=0.5mm

F I G . 3



RANGE OF MEASUREMENT 1~3A ,25 °C
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2.5
2
1.5
1
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.1
1
5
10
20
30
50
70
80
90
95
99
99.9
99.99
CUMULATIVE PERCENT [%]
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Lc=1.5mm
BLOCK STEM (Lc = 1.00)
BLOCK STEM (Lc = 1.50)
LD PACKAGE (Lc = 1.00)
LD PACKAGE (Lc = 1.50)

PTO/SB/106 (8-96)
Approved for use through 9/30/98. OMB 0651-0032
Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Declaration and Power of Attorney For Patent Application

特許出願宣言書及び委任状

Japanese Language Declaration

日本語宣言書

下記の氏名の発明者として、私は以下の通り宣言します。

As a below named inventor, I hereby declare that:

私の住所、私書箱、国籍は下記の私の氏名の後に記載された通りです。

My residence, post office address and citizenship are as stated next to my name.

下記の名称の発明に関して請求範囲に記載され、特許出願している発明内容について、私が最初かつ唯一の発明者（下記の氏名が一つの場合）もしくは最初かつ共同発明者であると（下記の名称が複数の場合）信じています。

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

SOLID-STATE LASER APPARATUS EXCITED BY LASER LIGHT FROM SEMICONDUCTOR LASER UNIT HAVING INCREASED RESONATOR LENGTH

上記発明の明細書（下記の欄でx印がついていない場合は、本書に添付）は、

the specification of which is attached hereto unless the following box is checked:

☐ __月__日に提出され、米国出願番号または特許協定条約国際出願番号を__________とし、（該当する場合）__________に訂正されました。

☐ was filed on __________ as United States Application Number or PCT International Application Number __________ and was amended on __________ (if applicable).

私は、特許請求範囲を含む上記訂正後の明細書を検討し、内容を理解していることをここに表明します。

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

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I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

PTO/SB/106 (8-96)
Approved for use through 9/30/98. OMB 0651-0032
Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Japanese Language Declaration
(日本語宣言書)

私は、米国法典第３５編１１９条(a)-(d)項又は３６５条(b)項に基き下記の、米国以外の国の少なくとも一ヵ国を指定している特許協力条約３６５(a)項に基ずく国際出願、又は外国での特許出願もしくは発明者証の出願についての外国優先権をここに主張するとともに、優先権を主張している、本出願の前に出願された特許または発明者証の外国出願を以下に、枠内をマークすることで、示しています。

I hereby claim foreign priority under Title 35, United States Code, Section 119 (a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)
外国での先行出願

			Priority Not Claimed 優先権主張なし
113482/1999	Japan	04/21/1999	☐
(Number) (番号)	(Country) (国名)	(Day/Month/Year Filed) (出願年月日)	
			☐
(Number) (番号)	(Country) (国名)	(Day/Month/Year Filed) (出願年月日)	

私は、第３５編米国法典１１９条(e)項に基いて下記の米国特許出願規定に記載された権利をここに主張いたします。

I hereby claim the benefit under Title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below.

(Application No.) (出願番号)	(Filing Date) (出願日)	(Application No.) (出願番号)	(Filing Date) (出願日)

私は、下記の米国法典第３５編１２０条に基いて下記の米国特許出願に記載された権利、又は米国を指定している特許協力条約３６５条(c)に基ずく権利をここに主張します。また、本出願の各請求範囲の内容が米国法典第３５編１１２条第１項又は特許協力条約で規定された方法で先行する米国特許出願に開示されていない限り、その先行米国出願書提出日以降で本出願書の日本国内または特許協力条約国際提出日までの期間中に入手された、連邦規則法典第３７編１条５６項で定義された特許資格の有無に関する重要な情報について開示義務があることを認識しています。

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s), or 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code Section 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of application.

(Application No.) (出願番号)	(Filing Date) (出願日)	(Status: Patented, Pending, Abandoned) (現況：特許許可済、係属中、放棄済)
(Application No.) (出願番号)	(Filing Date) (出願日)	(Status: Patented, Pending, Abandoned) (現況：特許許可済、係属中、放棄済)

私は、私自身の知識に基ずいて本宣言書中で私が行なう表明が真実であり、かつ私の入手した情報と私の信じるところに基ずく表明が全て真実であると信じていること、さらに故意になされた虚偽の表明及びそれと同等の行為は米国法典第１８編第１００１条に基ずき、罰金または拘禁、もしくはその両方により処罰されること、そしてそのような故意による虚偽の声明を行なえば、出願した、又は既に許可された特許の有効性が失われることを認識し、よってここに上記のごとく宣誓を致します。

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Japanese Language Declaration

委任状：私は、下記発明者として、以下の代理人をここに選任し、本願の手続を遂行すること並びにこれに関する一切の行為を特許商標庁に対して行うことを委任する。
（代理人氏名および登録番号を明記のこと）

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (*list name and registration number*)

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（第六またはそれ以降の共同発明者に対しても同様な情報および署名を提供すること。）

(Supply similar information and signature for third and subsequent joint inventors.)